

Edward W. Funk, Ph.D.

Chemical Engineering Consultant / Expert Witness

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Re: Soilworks v. Midwest Industrial Supply

I have been retained by Kutak-Rock LLP to evaluate if the Durasoil product infringes any of the Midwest products covered in US 7,074,266 and US 7,081,270.

Enclosed is my CV and list of technical publications, authored patents, and major presentations. I have particular experience with soil-type material from my research at Exxon- Mobil on separating valuable organics from tar sands, which are 90% clay and soil-type material. Over the last 5 years, I have given 6 depositions.

My conclusions are based on an understanding of the composition of Durasoil and an analysis of the Midwest patents US 7,074,266 and US 7,081,270.

First, the components of Durasoil. It contains white mineral oil which is generally defined as a very pure paraffinic hydrocarbon. The second component is light petroleum which has been hydro-treated to assure that it is paraffinic. The third component is a middle distillate from the fractionation of oil which has been hydro-treated. It also contains some esters; these are modified carboxylic acids.

Durasoil does not contain key components claimed in the above named Midwest patents. The Midwest product contains organic acids (carboxylic and fatty acids). This would give the product an acidic property where the paraffinic components in Durasoil give it a non-acidic property.

The Midwest product contains an emulsifier, which in industrial use are typically long-chained alcohols or fatty acids

Durasoil does not include an iso-alkane (a paraffinic component that has some branching rather than a straight chain material. Iso-alkanes do not naturally occur in petroleum but are manufactured in a specialized process (the most common synthetic iso-alkane is is-octane used in gasoline to increase performance).

The Midwest product includes a polyolefin (a low molecular weight polymer). This is used as a binder for the other organic components. Durasoil does not use polymeric materials or a binder.

From the above analysis, it is my conclusion that Durasoil is distinctly different from the materials claimed in the Midwest patents.



Edward W Funk, Ph D
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Appendix 1- EWF CV and publications

CURRICULUM VITAE -EDWARD W.FUNK, Ph. D.

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PROFESSIONAL SUMMARY

Experienced R&D director at Exxon and Honeywell and presently an expert witness along being a Professor of Chemical Engineering at University of Illinois.

EDUCATION

Ph.D., Chemical Engineering, University of California, Berkeley, 1970 B.S., Engineering Science, Yale, 1967

PRESENT PROFESSIONAL

1. Consultant and expert witness 1992-present. EWF Consulting, Inc. Technical consultant to medium-sized chemical companies and national laboratories. Expert witness on patent infringement and process/product liability cases with law firms.
2. Professor of Chemical Engineering, University of Illinois 1992-present Teaching of courses in process and product design. Technical writing and oral communication.

PREVIOUS EXPERIENCE

Allied-Signal/UOP (now Honeywell), Des Plaines, IL, 1982-1992
Manager of Chemical Process/Product Technology

- Responsible for the commercial development of new products in the areas of petrochemicals, polymers, membranes and films, environmental processes, and chemical processing, and novel process systems.
- This work led to new membranes, surface-modified films, ozone-friendly fluorocarbons, extraction processes for treating contaminated soils, conducting polymer resins, carbon molecular sieves, etc.
- Managed the advanced technology for UOP division of Honeywell, the process technology affiliate of Honeywell. This included petroleum processes and process technology in the food and related industries.

- Led the design effort that identified new commercial applications for oxygen-enrichment membranes and ultrafiltration processes for food processing.
- Lead technology manager in the Dow/Honeywell patent infringement suit, which resulted in a \$30 million award to Honeywell.
- Project Manager for a \$5 million Department of Energy contract on the development of energy saving membrane processes. The yield from this contract included the first commercial processes for hydrocarbon separations, and a gas-membrane process for removal of carbon dioxide from natural gas.
- Obtained for Honeywell R&D contracts from NASA and Los Alamos and established joint R&D projects with Kraft and Procter & Gamble.

Corporate Research, Exxon, Linden, NJ, 1973-1982

Senior Research Engineer.

- Established a new program on the extraction of oil from Canadian tar sands and obtained the key patents. Directed the laboratory studies, developed unique software for process analysis, and built a small-scale demonstration units.
- Developed new test methods for the characterization of asphaltenes, lubricating oils, and synthetic fuels.
- Served as the principal engineer in the investigation of potential uses of supercritical fluid technology within Exxon's business units.
- Was lead engineer of the engineering/chemistry team that commercialized Exxon's FLEXSORB process for the use of aqueous tertiary amines for removal of acid gases from natural gas.

Ford Foundation, Chile 1971-1973

Fellow

Established new R&D programs focused on the food and mineral industries within government labs and universities.

PROFESSIONAL ACTIVITIES

Author of 40 technical papers and 35 presentations at technical meetings, national laboratories and industrial research centers. Author of 6 US patents.

PUBLICATIONS / PRESENTATIONS / PATENTS

1. Funk, E.W., and Prausnitz, J.M., "Thermodynamic Properties of Liquid Mixtures: Aromatic-Saturated Hydrocarbon Systems," *Industrial and Engineering Chemistry*, 9, 8 (1970)
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3. Funk, E.W., and Prausnitz, J.M., "Vapor-Liquid Equilibria for Propane-Propylene," *AICHE Journal*, 17, 254 (1971)
4. Preston, G.T., Funk, E.W., and Prausnitz, J.M., "Solubilities of Hydrocarbons and Carbon Dioxide in Liquid Methane and Liquid Argon," *Journal of Physical Chemistry*, 75, 2345 (1971)
5. Funk, E.W., and Prausnitz, J.M., "Estimation of Binary Parameters (Henry's Constant and van Laar Parameter)," *IEC Process Design and Development*, 10, 405 (1971)
6. Funk, E.W., and Prausnitz, J.M., "Entropies of Vaporization for Fluorocarbons and Hydrocarbons from the Hildebrand Rules," *Journal of Physical Chemistry*, 75, 2530 (1971)
7. Preston, G.T., Funk, E.W., and Prausnitz, J.M., "Effect of Temperature on Henry's Constant for Simple Mixtures," *Physics and Chemistry of Liquids*, 2, 193 (1971)
8. Funk, E.W., Chai, F.C., and Prausnitz, J.M., "Thermodynamic Properties of Liquid Mixtures Containing Aromatic and Saturated Hydrocarbons," *Journal of Chemical and Engineering Data*, 17, 24 (1972)
9. Equilibrio de Fases en Sistemas de Petroleo, Congreso de Quimicos, Santiago, Chile, January, 1972
10. Funk, E.W., "Activity Coefficients at High Concentrations in the Hydrochloric Acid-Sodium Chloride-Water System," *IEC Process Design and Development*, 13, 352 (1974).
11. Vega, R., and Funk, E.W., "Solid-Liquid Equilibria in Concentrated Aqueous Salt Solutions - Systems with a Common Ion," *Desalination*, 15, (1974)
12. Irani, C., and Funk, E.W., "Supercritical Separations Using Gases," Chapter 3, Volume 4, *Recent Developments in Separation Science*, N.N. Li, Editor, 1976
13. Extraction of Athabasca Tar Sands, Laboratory Seminar, Imperial Oil., Sarnia, Canada, June, 1976
14. Heavy Hydrocarbon Processing: An Overview, Departmental Seminar, Chemical Engineering, University of California, Berkeley, California, 1977
15. Solvent Extraction of Tar Sands: The Process and Economics, Syncrude Canada Limited, Edmonton, Canada, November, 1977

16. Funk, E.W., and Gomez, E., "Determination of Vanadium in Athabasca Bitumen and Other Heavy Hydrocarbons by Visible Spectroscopy," *Analytical Chemistry*, 49, 972 (1977)
17. Funk, E.W., "Study of Heavy Hydrocarbons by Inverse-Phase Chromatography," *I&EC Product Research and Development*, 16, 115 (1977)
18. Funk, E.W., Irani, C.A., Espino, R.L., "Tar Sands Extraction Process," U.S. Patent 4, 036, 732 (July, 1977)
19. Funk, E.W., "Behavior of Tar Sand Bitumen with Paraffinic Solvents and its application to Separations for Athabasca Tar Sands," *American Chemical Society, Division of Fuel*, 23, 81 (1978)
20. Funk, E.W., "Athabasca Bitumen recovery Process," *Oilweek Canada*, October 23, 44 (1978)
21. Interfacial Effects in Separations for Tar Sands, Departmental Seminar, Chemical Engineering, University of Minnesota, July, 1978
22. Behavior of Athabasca Tar Sand Bitumen, American Chemical Society, Division of Fuel, Miami Beach, September, 1978
23. Thermodynamics of Aqueous Salt Systems, NSF Symposium on Thermodynamics Applied to Industrial Needs, Washington, D.C., October, 1979
24. Processing and Recovery of Heavy Hydrocarbons, Departmental seminar, McGill University, Montreal, Canada, November, 1979
25. Funk, E.W., "Behavior of Tar Sand Bitumen with Paraffinic Solvents," *Canadian Journal of Chemical Engineering*, 57, 333 (1979)
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28. Electrokinetics and Other Similar Effects, *The Filtration Society*, King of Prussia, Pa., March, 1980
29. Selective Absorption of Hydrogen Sulfide and Carbon Dioxide in Aqueous Solutions of Methyl-diethanolamine, *AICHE Meeting*, Houston, Texas, April, 1981
30. Phase Equilibria in Mixtures of Athabasca Bitumen with Alcohol and Paraffin Solvents, *AICHE Meeting*, Houston, Texas, April, 1981
31. Phase Equilibria of Heavy Hydrocarbon Systems, Departmental Seminar, Chemical Engineering, Yale University, February, 1982
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33. Funk, E.W., May, W.G., Pirkle, J.C., "Solvent Extraction Process for Tar Sands," U.S. Patent 4, 347, 118 (August, 1982)
34. Membrane Separation Processes, U.S. Department of Energy, Washington, D.C., September, 1982
35. Phase Equilibria of Heavy Hydrocarbon Systems, Departmental Seminar, Chemical Engineering, Illinois Institute of Technology, May, 1983
36. Membrane Separation Processes for Acid Gases, AIChE Summer Meeting, Denver, Colorado, August, 1983
37. Polymeric Membranes for Petrochemical Separations, Departmental Seminar, Chemical Engineering, University of Illinois at Chicago, October, 1983
38. Membrane Separations for Liquid Systems, Membrane Symposium, U.S. Department of Energy, University of Texas, Austin, Texas, October, 1983
39. Membrane Separations with Polymeric films, ACS Meeting, Rock River Selection, Beloit College, November, 1983
40. Separations for Closed-Loop Space Stations, Marshall Spacecraft Center, Huntsville, Alabama, September, 1984
41. Membrane Separations for Hydrocarbon Systems, U.S. Department of Energy Symposium, Clemson University, October, 1984
42. Membrane Systems for Spacecraft Living, NASA Ames Research Laboratory, San Jose, California, October, 1984
43. An Industrial Perspective on Teaching Separation Science, AIChE National Meeting, San Francisco, November, 1984
44. Funk, E.W., May, W.G., and Pirkle, J.C., "Processing Approach for the Solvent Extraction of Athabasca Tar Sands," AIChE Energy Progress Quarterly, 4, 12 (1984)
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47. Membrane Separations in This World and Beyond, Departmental Seminar, Chemical Engineering, Michigan State University, October, 1985
48. Membrane Technology for Acid Gas Separation, DOE Membrane Symposium, Knoxville, Tennessee, October, 1985
49. Novel Separations with Polymeric Membranes, Departmental Seminar, Chemical Engineering, Northwestern University, Evanston, Illinois, March, 1986
50. The Effect of Impurities on Membrane Performance, AIChE Meeting, New Orleans, April, 1986

51. Application of Membrane Technology in the Paper and Pulp Industry, American Chemical Society, New York, April, 1986
52. Advanced Membranes for Spacelab Water Management, American Chemical Society, New York, April, 1986
53. Funk, E.W., Chang, Y.A., Kulkarni, S.S., "Membrane Separation of Hydrocarbons," U.S. Patent 4, 595, 507 (June, 1986)
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65. Funk, E.W., Kulkarni, S.S., Gatsis, J., "Membrane Separation of Hydrocarbons Using Cycloparaffinic Solvents," U.S. Patent 4, 750, 990 (June, 1988)
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72. Membrane Technology Applications in the Chemical Process Industries, Short Course, International Congress on Membranes and Membrane Processes, Chicago, August, 1990

73. Membrane Separations in the Petrochemical Industry, 8th Annual Membrane Technology Planning Conference; BCC Communications, Newton, MA., October, 1990

74. New Membrane Processes for Oil Upgrading, Chevron Research Membrane Conference, Richmond, CA., November, 1990

75. New Membrane Processes in an Environment of Change, Departmental Seminar, Chemical Engineering, Northwestern University, April, 1991

76. Organic Separations with Membranes, First Hanford Separation Symposium, Richland, Washington, July, 1991

77. New Applications of Membrane Technology for the Chemical Industry, Plenary Lecture, Canadian Chemical Engineering Society, Vancouver, October, 1991

78. Manufacturing Process for Cellulose Acetate Membranes and Industrial Uses, 7th Symposium on Separation Science and Technology, Knoxville, Tennessee, October, 1991

79. Mixed Matrix Membranes, AIChE National Meeting, Los Angeles, CA, November, 1991

80. Ultrafiltration, Chapters 27-31. Membrane Handbook, Van Nostrand Reinhold, New York, NY, 1992.

81. Process Analysis of Membrane Separations, Departmental Seminar, University of Illinois, Urbana, IL, April, 1992

82. Surface Modification of Membranes, 10th Annual Membrane Technology Planning Conference, BCC Communications, Newton, MA, October, 1992

83. Membranes Tailored for Aqueous Phase Separations, AIChE National Meeting, Miami Beach, FL, November, 1992

84. Inorganic Separation Technology, Invited Lecture, Los Alamos National Laboratory, November, 1992 .

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